CHAPTER 9. SEASONAL SAMPLING PLAN

This chapter explores the problem of sampling sparse WIM data to generate estimates of traffic inputs for MEPDG. Previous research has shown that sampling improvements can be achieved by increasing the sample repetitions, testing more sampling schemes, including the predictable seasonal variation (stability) of truck traffic, and establishing a baseline comparing the sampled estimates of ALDF to the ALDF from annual WIM data. The proposed NC sampling scheme has different frequencies (annual, semiannual, quarterly, and monthly) and different lengths of sampled data (two consecutive weekdays and five consecutive weekdays). The sampling analysis showed that the choice of the proper sampling scheme depends on the seasonal variation of the truck traffic.

9.1 Introduction

9.1.1 Background

The 2002 MEPDG developed under National Cooperative Highway Research Study 1-37A is based on mechanistic-empirical (M-E) pavement damage analysis that requires truck traffic data for new and rehabilitated pavement design [*NCHRP Project 1-37A,2004*]. Among the required traffic data are ALDF, MAF, HDF, and VCD. Weight-in-motion (WIM) stations continuously collect weight data for each passing vehicle in addition to volume data by vehicle class. The comprehensive range of traffic data collected by WIM sites makes them an appealing option for DOTs to collect traffic data for M-E design. However, WIM sites require sophisticated data collection sensors, controlled operating environment (strong, smooth, level pavement in good condition), and costly equipment for set up and calibration [*TMG, 2001*]. Given resource limitations and budget constraints at state DOTs, it has been challenging to provide optimum requirements for WIM sites to collect and to report complete data for long periods of time. There are also unexpected situations in which a WIM site may be destroyed or damaged or perform intermittently. In such circumstances, DOTs need guidelines for efficient and reliable data collection and sampling schemes. Thus, this chapter seeks to answer to the question: "How much WIM data collected at an individual site is enough to characterize the truck traffic for use in M-E pavement design?"

9.1.2 Literature Review

Over the last decade, researchers and practitioners have developed numerous approaches to generate traffic input for MEPDG [*Kim et al. 1998, Prozzi and Hong 2005, Papagiannakis (a) 2006, Lu and Harvey 2006, Tran and Hall 2007, Wang et al. 2007, Swan et al. 2008, Sherif et al. 2010*].North Carolina has also participated in this national effort geared toward characterizing the traffic input for MEPDG [*Sayyady et al. 2010, Ramachandran et al. 2010*]. Using NC WIM data, MEPDG damage-based sensitivity analysis showed that pavement performance is sensitive to NC site-specific ALDF and VCD. The approach to generate VCD factors is to employ a seasonal factoring procedure that converts the site-specific 48-hour classification counts into annual average truck volumes which are used to generate site-specific VCD inputs. Based on sensitivity analysis results, pavement performance is found to be insensitive to NC site-specific and national default values of HDF and MAF, thus the NC approach is to use the average statewide HDF and MAF values as input to MEPDG. In light of the different approaches used to generate VCD, HDF, and MAF, a potential sampling scheme should primarily focus on ALDF. Obviously, if we have a year of data, we have all the data we need to generate ALDF input. However, for less than a year, how much data is sufficient for a reliable ALDF estimate for MEPDG?

Several research projects have studied the problem of sampling sparse WIM data. For example, to improve the quality of the load data the Long Term Pavement Performance (LTPP) program